CRITERIA FOR GOLDEN EAGLE, FERRUGINOUS HAWK, AND PRAIRIE FALCON NEST SITE PROTECTION*

by
Glenn W. Suter, II.
Environmental Sciences Division
Oak Ridge National Laboratory
Oak Ridge, Tennessee 37830
and
Jan L. Joness**
Biology Department
University of Virginia
Charlottesville, Virginia 22903

Abstract

Establishment of buffer zones around raptor nest sites has become an important management tool in areas undergoing energy development or increasing recreational pressure. We conducted a survey of field researchers who had distributed Golden Eagle, Ferruginous Hawk, and Prairie Falcon during their research. Bases for and limitations of the use of buffer zones to protect nesting raptors are discussed.

Introduction

Energy development and other human activities can diminish raptor populations by altering habitat and by disturbing nesting activities. Disturbance of nesting raptors can result in complete desertion of nests, eggs, or young. Temporary departure by adults can cause overheating, chilling, or desiccation of eggs or young, predation on eggs or young, or missed feedings. Three studies of the Golden Eagle (*Aquila chrysaëtos*) found that 46, 71, and 85 percent of nesting failures were due to human disturbance (Boeker and Ray 1971, Camenzind 1969, D'Ostilio 1954). The effects of such disturbance range from loss of a year's reproduction to long-term loss of the nest site if the disturbance is chronic. Raptor researchers found that by disturbing birds they can jeopardize the reproductive activity being studied (Fyfe and Olendorff 1976).

Concern over disturbance has resulted in the establishment of spatial or temporal buffers (restriction of activity within an area or period of time) between some energy developments and raptor nest sites. Geothermal development proposals for sites in Utah and Idaho resulted in recommendations for buffers by federal agencies (ERDA 1977, Fisher 1978, USGS 1977). Buffer zones were established to protect raptor nest sites along the Trans-Alaska pipeline (Olendorff and Zeedyk 1978) and were recommended for the proposed Mackenzie gas pipeline (Jacobson 1974). These recommendations were based primarily on the experience of the individuals involved because of the absence of a body of literature on responses of the birds to these disturbances or any consensus of the raptor research community concerning control of disturbance. This study summarizes and expands the bases for such decisions relative to the Golden Eagle, Ferruginous Hawk (*Buteo regalis*), and Prairie Falcon (*Falco mexicanus*).

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**Present address: U.S. Fish and Wildlife Service, Piedmont National Wildlife Refuge, Round Oak, Georgia 31080.

Methods

Raptor field research usually involves some disturbance and often allows observation of the effects of other sources of disturbance. Unfortunately, these observations are not routinely reported. To get information, a survey form (table 1, shown with results) was sent to 74 appropriate raptor researchers; a second copy was sent to nonrespondents 2 months later. Questions were framed in terms of the level of disturbance that would elicit a reaction from 20 percent of nesting birds. This criterion was used to avoid the high variance associated with estimates of the reaction of a hypothetical, most sensitive bird. Because the Golden Eagle, Ferruginous Hawk, and Prairie Falcon are not classified as threatened or endangered, protection need not be absolute. These species were chosen because they are the most sensitive raptor species with which western developments will frequently conflict.

Because some survey returns indicated that the use of buffer zones is controversial, a workshop on raptor disturbance was conducted at the 1978 Raptor Research Foundation meeting. While the large attendance and short duration of this workshop prevented the formulation of a consensus, the issues were clearly defined and are discussed below.

Results

Twenty-four surveys were completed and returned with numerical information; 6 additional respondents provided only comments. Numerical results are summarized in table 1. Since the distribution of responses to each question was positively skewed, the median provides the best measure of central tendency. The median is also more useful than the mean because it represents a central or typical response rather than the average magnitude of responses. Median reaction distances were lowest for the Prairie Falcon and highest for the Ferruginous Hawk, but most of the differences between species were not statistically significant.

Factors other than distance and stage in the breeding cycle that were thought to be important in determining the response to a particular disturbance by more than one respondent were existence of a clear line of sight, security of the nest, history of disturbance to which the birds have been exposed, elevation of the disturbance relative to the nest, and whether the birds were the focus of attention. Recommended buffer zones for these species found in the literature or received in response to the surveys are presented in table 2.

Discussion

The objection to nest-site protection most frequently raised at the workshop was that the entire habitat must be protected. If this were necessary, raptors would be absent from areas supporting any human activity. The habitat factors requiring protection are those that limit the population size or that may become limiting as a result of development. Olendorff and Stoddard (1974) found that nest-site availability apparently limits raptor poulations in northeastern Colorado and southeastern Washington. Edwards (1969) found that Golden Eagle density was limited by nest-site availability in western Utah, and Boeker and Ray (1971) found the same to be true for the Southwest in general. Smith and Murphy (1978) attribute the low nesting density of Ferruginous Hawks primarily to nest-site limitations. This is likely to be the case in much of the arid and semiarid west when a sufficiently large area is considered because prey habitat is abundant relative to nesting habitat. Golden Eagles and Prairie Falcons typically require cliff

Table 2. Recommended Buffer Zones for Golden Eagle, Ferruginous Hawk, or Prairie Falcon Nest Sites.

Distance	Species	Development type	Restriction	Source
1 km (0.6 mile)	Golden Eagle Prairie Falcon	Geothermal drilling	No drilling	ERDA 1977
0.5 mile (0.8 km) all year and 1 mile (1.6 km) March 1–July 15	Ferruginous Hawk	Geothermal drilling	No surface disturbance	Fisher 1978
1 mile (1.6 km)	All eagles	Pipeline		Olendorff and Zeedyk 1978
2 miles (3.2 km) all year	Golden Eagle	Pipeline	No construction	Jacobson 1974
2 miles (3.2 km) March 1–Sept. 1	Golden Eagle	Pipeline	No ground activity	Jacobson 1974
0.25–0.5 mile (0.4–0.8 km)	Golden Eagle	General		M. R. Fuller[a]
200–500 m	All three species	General		N. Woffinden[a]
0.5 mile (0.8 km)	Grassland raptors	General		R. P. Howard[a]
1 mile (1.6 km) line of sight	Golden Eagle	General		R. P. Howard[a]

[a]Suggestions received in response to the raptor disturbance survey.

sites. Ferruginous Hawks are more versatile, but most require a tree or rock outcropping. This use of elevated nest sites contrasts sharply with the open-land hunting habit of these species. The importance of nest sites is confirmed by Fyfe and Armbruster's (1976) and Anderson and Follet's (1978) success in increasing the productivity of Prairie Falcons and Ferruginous Hawks, respectively, by nest-site creation and manipulation (see also Howard and Hilliard 1980, White 1974).

Nest-site protection is only advantageous if the prey base remains adequate following development. Many types of development such as oil, gas, and geothermal exploitation, pipeline and road construction, and development of campgrounds and interpretive facilities on public lands remove vegetation from small areas. If important prey concentrations such as ground squirrel colonies are avoided, raptors should be able to coexist with these developments provided nesting sites are undisturbed. The responses to survey question 5 indicate that development should be kept at least 400 m from such prey concentrations.

Another objection to nest-site protection was that disturbance might occur because of the establishment of buffer zones. This disturbance could be caused by irate supporters of the development that would be restricted or by nest robbers, varmint shooters, amateur naturalists, or photographers who are attracted to identified nest sites. The location of nest sites should be revealed only to those who are directly involved in facility siting. Developers should be reminded that the nest site, not the individual birds, is being protected. Shooting the birds would not eliminate the need to restrict development near the site.

General suggestions for buffer zone sizes can be made on the basis of survey responses. To avoid thermal stress to eggs or young, activities such as geological, biological, or soil surveys that are performed intermittently by a few individuals should be kept at least 500 m from active nest sites or limited to a few minutes and periods of moderate temperature. Construction and similar noisy, extended activities should be kept at least 1 km from nest sites to avoid nest abandonment. At this distance, nesting birds are also out of rifle range and are relatively inconspicuous to users of new roads or other facilities. These suggested distances lie within the range of buffer zone sizes listed in table 2. They are not absolute and should be modified by knowledgeable individuals to fit the circumstances of the project and nest site. Knowledgeable advice is also necessary to determine if buffer zones are the appropriate management tool for the circumstances.

Temporal buffers may supplement or be used in place of spatial buffers. Temporal buffers should include all nesting activities but must at least extend from the time of arrival of the adult birds in the nesting area through the first few weeks of nestling development (see Call 1978 for average dates). After this time young are increasingly able to thermoregulate, and adults are reluctant to abandon them. Activity close to the nest (within flushing distance) must wait until fledging is completed and young are independent of the nest area. The use of temporal buffers depends on the ability to schedule activities on an annual basis.

A second alternative to spatial buffers around existing nest sites is the construction of artificial nesting sites. This technique was reviewed by Olendorff and Stoddard (1974) as a method to introduce raptors into unused grassland. The disadvantages of artificial sites as a mitigation technique are that they may not always prove acceptable to the displaced species, they may attract the "wrong" species, and they are typically more conspicuous than natural sites.

Further support for raptor preservation must be provided by field research. One approach is to experimentally disturb nesting birds (White et al. 1979). This type of research is limited by the ability to realistically simulate development activities and by the small number of pairs available. The most valuable information will come from the monitoring of responses to real developments and observation of the distribution of active nests relative to ongoing human activities. These observations should appear more frequently in the literature.

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Literature Cited

Anderson, W. C., and T. M. Follet. 1978. Nest-site management techniques for increasing productivity of grassland raptors (Abstract). Page 1 in Raptor Research Foundation Annual Conference, East Stroudsburg State College, East Stroudsburg, Pennsylvania.

Table 1. Responses to the raptor disturbance survey (distances in meters).

Question	Golden Eagle			Ferruginous Hawk			Prairie Falcon		
	Med	Range	n	Med	Range	n	Med	Range	n
1. At what distance would an individual or small group of people approaching a nest cause 20% of sitting birds of each species listed to flush from the nest during the following periods?									
a. laying	160	15-1073	16	275	91-1609	17	166	15-1609	14
b. incubation	100	15-805	17	274	5-805	18	91	15-402	15
c. rearing young	333	15-1609	16	337	75-1609	18	250	15-610	15
2. At what distance would extended activities involving several persons and approximately 90 dBA noise, e.g., drilling or earth moving, cause abandonment of the nest by 20% of individuals of each species during the following periods?									
a. nest construction	550	250-4023	16	902	300-3218	15	366	61-1609	13
b. laying	478	250-4023	16	600	105-3218	16	400	61-1609	15
c. incubation	402	150-1609	15	451	100-1609	16	366	30-1295	15
d. rearing young	383	100-1609	16	333	30-1609	16	274	30-805	15
3. At what distance would a noisy [illegible]									

species listed to flush from a nest during the following periods?									
a. laying	183	30-2414	15	402	91-3218	16	191	30-1609	14
b. incubation	187	30-2414	16	366	25-1609	15	126	25-805	14
c. rearing young	350	30-2414	15	384	75-1609	14	183	30-805	14
4. At what distance would frequent (1 per hour) noisy off-road vehicles cause abandonment of the nest by 20% of the individuals of each species during the following periods?									
a. nest construction	457	91-5632	15	500	91-3218	14	274	91-1407	11
b. laying	457	91-2414	15	451	75-1609	14	201	46-1609	13
c. incubation	402	91-2414	15	383	75-1609	14	200	46-805	13
d. rearing young	200	50-2414	15	250	25-1609	14	200	30-805	13
5. Within what distance of an activity involving several people and large equipment would at least 80% of the members of each species hunt and kill prey?	400	30-3218	15	402	30-3218	17	320	30-1609	13
6. What factors, other than distance and stage in the breeding cycle, do you believe are important in determining the probability that a particular activity will cause a bird of the above species to temporarily or permanently abandon a nest site?						(See text)			

Boeker, E. L., and T. D. Ray. 1971. Golden Eagle population studies in the Southwest. *Condor* 73:463–467.

Call, M. W. 1978. Nesting habitats and surveying techniques for common western raptors. Technical Note TN-316, Bureau of Land Management. Denver Service Center, Denver, Colorado. 115 pp.

Camenzind, F. J. 1969. Nesting ecology and behavior of the Golden Eagle (*Aquila chrysaetos L.*). *Brigham Young Univ. Sci. Bull. Biol. Ser.* 10(4):4–15.

D'Ostilio, D. O. 1954. Nesting status and food of the Golden Eagle in northern Colorado. Master's thesis, University of Colorado, Boulder. 48 pp.

Edwards, C. 1969. Winter behavior and population dynamics of American eagles in western Utah. Ph.D. dissertation, Brigham Young University, Provo, Utah. 142 pp.

Energy Research and Development Administration (ERDA). 1977. EIA for CU1 Venture application for geothermal loan guarantee (Beryl and Lund, Utah). EIA/GE/77-8. Washington, D.C. 109 pp.

Fisher, R. J. 1978. Biological values in the Raft River Valley geothermal resource area. Appendix A in Department of Energy Environmental Assessment. Raft River Geothermal Project, Thermal Test Loop, Cassia County, Idaho. DOE/EA-0008. U.S. Department of Energy, Washington, D.C. 121 pp.

Fyfe, R. W., and H. I. Armbruster, 1976. Raptor research and management in Canada. Pages 282–293 in R. D. Chancellor, ed., *First world conference on birds of prey, Vienna,* 1975. Proc., ICBP, London.

Fyfe, R. W., and R. R. Olendorff. 1976. Minimizing the dangers of nesting studies to raptors and other sensitive species. Occasional Paper No. 23, Canadian Wildlife Service, Ottawa. 16 pp.

Howard, R. P., and M. Hilliard. 1980. Artificial nest structures and grassland raptors. *Raptor Res.* 14:41–45.

Jacobson, J. O. 1974. Potential impact of the Mackenzie gas pipeline on bird populations in the Yukon and Northwest Territories. Pages 121–176 in *Research Reports,* vol. IV. Environmental impact assessment of the portion of the Mackenzie gas pipeline from Alaska to Alberta. Environmental Protection Board, Winnipeg, Manitoba, Canada.

Olendorff, R. R., and J. W. Stoddard, Jr. 1974. The potential for management of raptor populations in western grasslands. Pages 47–88 in F. N. Hamerstrom, Jr., B. E. Harrell, and R. R. Olendorff, eds., *Management of raptors.* Raptor Research Report No. 2. Raptor Research Foundation, Inc. Vermillion, South Dakota.

Olendorff, R. R., and W. D. Zeedyk. 1978. Land management for the conservation of endangered birds. Pages 419–428 in S. A. Temple, ed., *Endangered birds.* University of Wisconsin Press, Madison, Wisconsin.

Smith, D. G., and J. R. Murphy. 1978. Biology of the Ferruginous Hawk in central Utah. *Sociobiology* 3:79–95.

U.S. Geological Survey. 1977. Environmental analysis prepared for the drilling of seven 5,500-foot exploratory wells in the Beowawe Unit, Lander County, Nevada, EA #55. Office of the Area Geothermal Supervisor, Menlo Park, California. 131 pp.

White, C. M. 1974. Current problems and techniques in raptor management and conservation. Pages 301–312 in J. B. Trefethen, ed., Transactions of the thirty-ninth North American Wildlife and Natural Resources Conference. Wildlife Management Institute, Washington, D.C.

White, C. M., T. Thurow, and J. F. Sullivan. 1979. Effects of controlled disturbance on Ferruginous Hawks as may occur during geothermal energy development. Pages 777–779 in Transactions, vol. 3, Geothermal Resources Council, Davis, California.